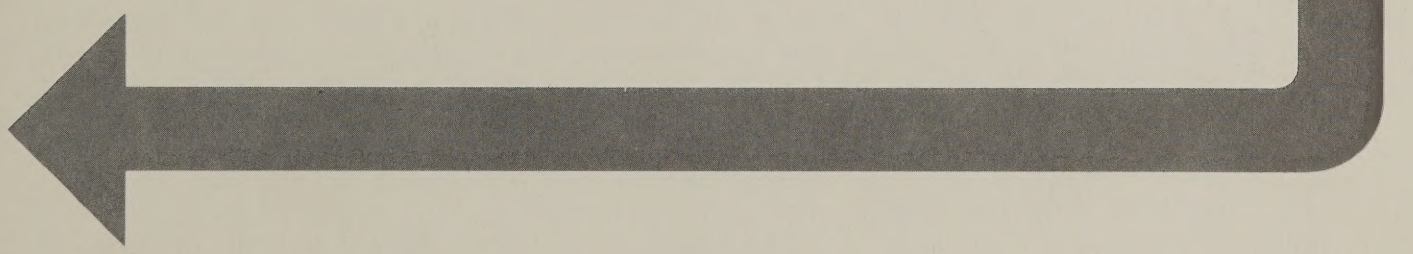
 **COMMUNICATIONS INC.**

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SERVICE MANUAL

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UHF POWER AMPLIFIER



MODELS **ACU45A, ACU45B**
 AASCU45A, AASCU45B

1941-1942

1941-1942

1941-1942

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THEORY OF OPERATION

The Regency ACU45 Series is a series of UHF power amplifiers in the UHF (450-512 MHz) communications band with a band split from 450-476 MHz, designated A and 470-512 MHz, designated B. The series is capable of amplifying an input power level of 0.5W to 45W. The ACU45A/B is designed for use with the MCCU01RA/B and MCCU01DA/B rack mount UHF transceivers. The AASCU45A/B is designed for use with the MCCU01A/B rack mount UHF transceiver. The difference between the ACU45A/B and the AASCU45A/B is that the AASCU45A/B has an additional antenna switch for simplex operation. A circuit description will follow.

The predriver (Q101) is a class C amplifier in the frequency range 450-512 MHz. It amplifies a 0.5W signal from the exciter to 3.0W with a DC collector current of 0.5A. The input match circuit consists of C101, C102 and the microstrip between them. The output of Q101 is matched to the input of the driver (Q102) with C105, C106, C112 and the microstrip between them.

The driver (Q102) is a class C amplifier in the frequency range 450-512 MHz. It amplifies the 3.0W output of Q101 to 15W with a DC collector current of 1.5A. The output of Q102 is matched to the input of the final amplifier (Q103) with C111, C113, C114, C115 and the microstrip between them.

The final amplifier (Q103) is a class C amplifier in the 450-512 MHz frequency range. It amplifies the 15W output of Q102 to 45W with a DC collector current of 7A. The output of Q103 is matched to 50 ohms with C118, C120, C123, C135 and the microstrip line.

The final amplifier (Q103) is protected from a short or open circuit at the output of the ACU45 by a VSWR detection circuit which controls the amount of drive to the ACU45 and thus its power output, Q105, controls the VSWR voltage feedback to the final device in the exciter. With a good match on the output both Q104 and Q105 are saturated and the VSWR voltage and exciter drive are both maximums. When the microstrip directional coupler senses sufficient reflected power at the output, both Q104 and Q105 come out of saturation, the power output of the ACU45 is reduced and Q103 is protected.

The antenna switch (AASCU45A/B only) isolates the receiver from the transmitter and switches the antenna between the transmitter output and the receiver input. In the transmit mode keyed 13.6 biases both CR101 and CR102 on thus providing an RF path from the transmitter to the antenna and shorting the receiver input. In receive mode both CR101 and CR102 have no bias and act as open circuits.

A low pass filter attenuates the higher order carrier harmonics to at least 60dB below the carrier. The filter components are C127, L111 and C128.

SPECIFICATIONS

Frequency range.....450 - 512 MHz 2 bands
Operating Temp.....-30°C to +60°C
Size (W-D-H).....19" x 10" x 5¼"
rack mounted
Weight.....9.0 lbs.
Power.....13.6 VDC
Current drain.....@ 13.6 VDC
Transmit.....10A
Antenna.....50 ohms

TRANSMITTER

Pwr Output

@ EIA intermittent.....45W
@ continuous key.....35W

DC power into final.....100W

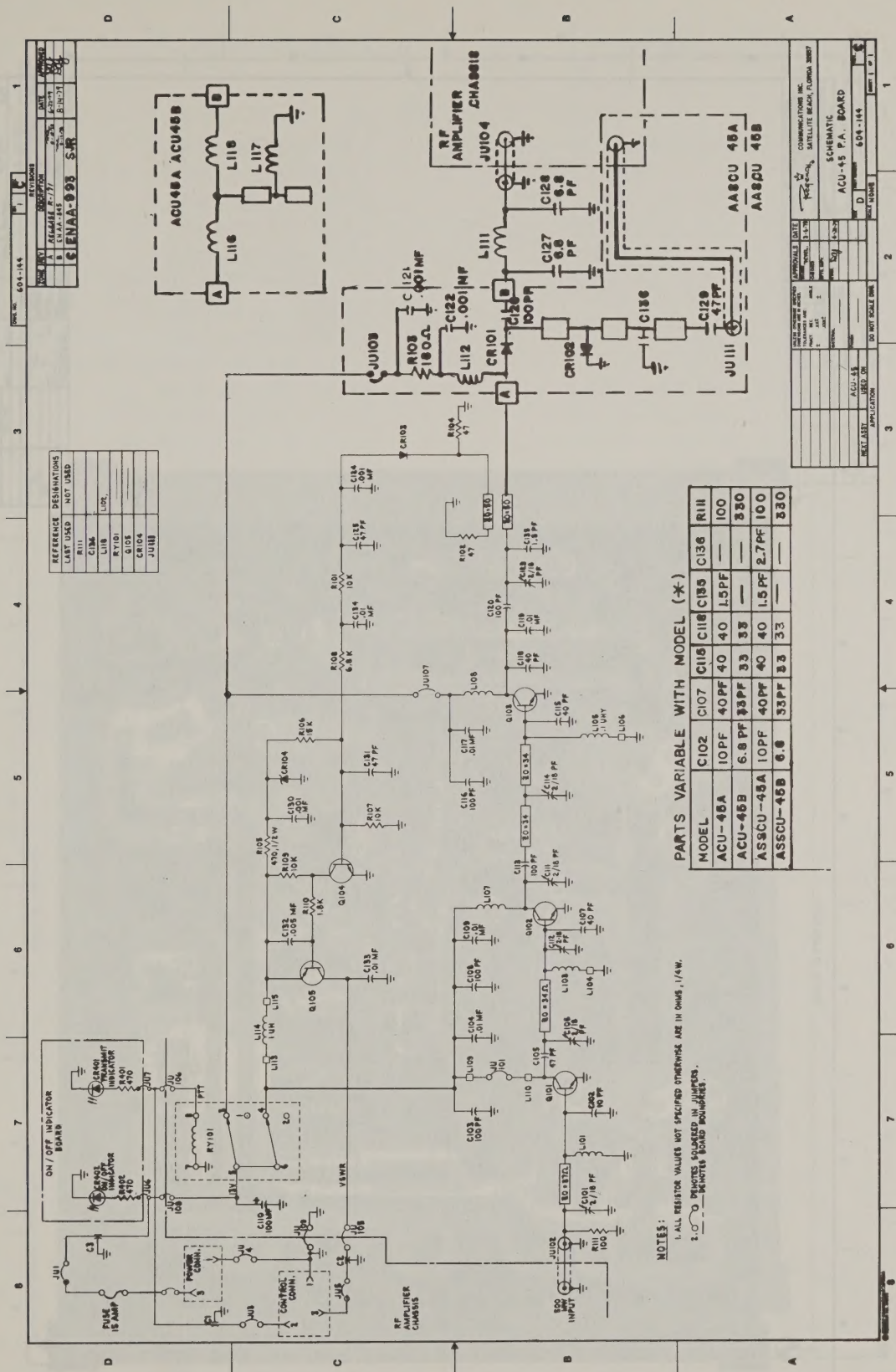
Spur & harm conducted.....-60dB max

Spur & harm radiated.....-60dB max

Operating bandwidth.....+5 MHz

Trans carrier attack.....EIA 100ms max

ACU45A, ACU45B
AASCU45A, AASCU45B



PARTS LIST

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> | <u>MODEL (S)</u> <u>UNIQUE TO</u> |
|-------------------|------------------------|--------------------|--------------------------------------|
| <u>CAPACITORS</u> | | | |
| C101 | 2.5-20pf TRIM | 1517-0000-034 | |
| C102 | 10pf CD 10 NPO 500V | 1500-0100-905 | ACU45A, AASCU45A |
| C102 | 6.8pf CD 10 NPO 500V | 1500-0689-905 | ACU45B, AASCU45B |
| C103 | 100pf CD 10 500V | 1500-0101-905 | |
| C104 | .01mf CD +8-2 500V | 1503-0103-008 | |
| C105 | 47pf MICA 10 T101 | 1522-0470-002 | |
| C106 | 2.5-20pf TRIM | 1517-0000-034 | |
| C107 | 40pf MICA | 1522-5418-303 | ACU45A, AASCU45A |
| C107 | 33pf MICA | 1522-5418-304 | ACU45B, AASCU45B |
| C108 | 100pf CD 10 500V | 1500-0101-905 | |
| C109 | .01mf CD +8-2 500V | 1503-0103-008 | |
| C110 | 100mf E 16V 85D Type U | 1513-0101-002 | |
| C111 | 2-18pf TRIM | 1517-0000-041 | |
| C112 | 2.5-20pf TRIM | 1517-0000-034 | |
| C113 | 100pf MICA 10 T101 | 1522-0101-002 | |
| C114 | 2-18pf TRIM | 1517-0000-041 | |
| C115 | 40pf MICA | 1522-5418-303 | ACU45A, AASCU45A |
| C115 | 33pf MICA | 1522-5418-304 | ACU45B, AASCU45B |
| C116 | 100pf CD 10 500V | 1500-0101-905 | |
| C117 | .01mf CD +8-2 500V | 1503-0103-008 | |
| C118 | 40pf MICA | 1522-5418-303 | ACU45A, AASCU45A |
| C118 | 33pf MICA | 1522-5418-304 | ACU45B, AASCU45B |
| C119 | .01mf CD 100V | 1501-0103-010 | |
| C120 | 100pf MICA 10 T101 | 1522-0101-002 | |
| C121 | .001mf CD +8-2 50V | 1503-0102-003 | AASCU45A, AASCU45B |
| C122 | .001mf CD +8-2 50V | 1503-0102-003 | AASCU45A, AASCU45B |
| C123 | 2-18pf TRIM | 1517-0000-041 | |
| C124 | .001mf CD +8-2 50V | 1503-0102-003 | |
| C125 | 47pf RD 5 NPO 50V | 1524-0470-002 | |
| C126 | 100pf MICA 5 250V | 1522-0101-007 | AASCU45A, AASCU45B |
| C127 | 6.8pf CD 10 NPO 500V | 1500-0689-905 | |
| C128 | 6.8pf CD 10 NPO 500V | 1500-0689-905 | |
| C129 | 47pf RD 5 NPO 50V | 1524-0470-002 | AASCU45A, AASCU45B |
| C130 | .001mf CD +8-2 50V | 1503-0102-003 | |
| C131 | 47pf RD 5 NPO 50V | 1524-0470-002 | |
| C132 | .005mf +8-2 50V | 1503-0502-005 | |
| C133 | .01mf RD +8-2 50V | 1503-0103-007 | |
| C134 | .01mf RD +8-2 50V | 1503-0103-007 | |
| C135 | 1.5pf .25 NPO 500V | 1500-0159-205 | ACU45A, AASCU45B |
| C136 | 2.7pf CD .25 NPO 500V | 1500-0279-205 | AASCU45A |

RESISTORS (all resistors are $\frac{1}{4}$ W, 5% unless otherwise noted)

| | | | |
|------|------------------------------|---------------|--------------------|
| R101 | 3.9K | 4704-0392-032 | |
| R102 | 47 ohm comp $\frac{1}{4}$ 10 | 4700-0470-042 | |
| R103 | 180 comp 1 W 10 | 4700-0181-045 | AASCU45A, AASCU45B |
| R104 | 47 ohm comp $\frac{1}{4}$ 10 | 4700-0470-042 | |
| R105 | 470 ohm $\frac{1}{2}$ 10 | 4701-0471-044 | |
| R106 | 15K | 4704-0153-032 | |
| R107 | 10K ohm | 4704-0103-032 | |

ACU45A, ACU45B

AASCU45A, AASCU45B

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> | <u>MODEL (S) UNIQUE TO</u> |
|----------------------|-----------------------|--------------------|--------------------------------|
| R108 | 3.9K | 4704-0392-032 | |
| R109 | 10K ohm | 4704-0103-032 | |
| R110 | 1K | 4704-0102-032 | |
| R111 | 100 ohm carb comp 10 | 4700-0101-042 | ACU45A, AASCU45A |
| R111 | 330 ohm comp 10 | 4700-0330-042 | ACU45B, AASCU45B |
| <u>COILS, CHOKES</u> | | | |
| L101 | choke LM-2 | 1803-5125-902 | |
| L102 | not used | | |
| L103 | .1 uhy choke rf | 1802-0108-008 | |
| L104 | ferrite bead | 2502-0000-001 | |
| L105 | .1 uhy choke rf | 1802-0108-008 | |
| L106 | ferrite bead | 2502-0000-001 | |
| L107 | choke LM-2 | 1803-5125-902 | |
| L108 | .15 uhy choke rf | 1803-3269-000 | |
| L109 | ferrite bead | 2502-0000-001 | |
| L110 | ferrite bead | 2502-0000-001 | |
| L111 | choke molder 1½ turns | 1803-5125-907 | |
| L112 | choke 1 uh | 1802-0010-008 | AASCU45A, AASCU45B |
| L113 | ferrite bead | 2502-0000-001 | |
| L114 | 10 uhy choke rf | 1802-0010-008 | |
| L115 | ferrite bead | 2502-0000-001 | |
| L116 | braid flat | 6011-0000-002 | ACU45A, ACU45B |
| L117 | braid flat | 6011-0000-002 | ACU45A, ACU45B |
| L118 | braid flat | 6011-0000-002 | ACU45A, ACU45B |
| <u>DIODES</u> | | | |
| CR101 | diode pin UM9484 | 4815-3408-600 | AASCU45A, AASCU45B |
| CR102 | diode pin UM9484 | 4815-3408-600 | AASCU45A, AASCU45B |
| CR103 | diode sil IN4148 | 4805-1241-200 | |
| CR104 | diode zener IN5231B | 4804-0000-031 | |
| <u>TRANSISTORS</u> | | | |
| Q101 | MRF 629 | 4804-3402-301 | |
| Q102 | MRF 641 | 4804-3269-803 | |
| Q103 | MRF 646 | 4804-3269-804 | |
| Q104 | SPS-951-1 | 4801-0000-016 | |
| Q105 | pwr PNP SJE 1608 | 4802-0000-003 | |
| <u>RELAY</u> | | | |
| RY101 | relay 12V | 4500-3251-900 | |

| | | | | | | |
|--------|-------------|---------|-----------|-------------|----------|----------|
| REV. 3 | APPLICATION | | REVISIONS | | | |
| | NEXT ASSY | USED ON | REV | DESCRIPTION | DATE | APPROVED |
| | | AC 445 | A | R 200 | 11/17/79 | DLF |
| SH 1 | | | B | AB 614 | 2-13-81 | DOJ |

TEST PROCEDURE

ACU45 RF POWER AMPLIFIER

I. Test Set-Up (Refer to Figure 1)

1. ACU45 Power Amplifier
2. UHF Power Generator } MCCU01 or MCCU01R exciter tuned per instructions in
3. Pad } Service Manual. 400 mw minimum to 1.5W maximum input
4. Wattmeter UHF 1W } power range to ACU45.
Element
5. Wattmeter UHF 100W Element
6. 50 ohm load
7. Power Supply 13.6 VDC @ 15A
8. Ammeter 15A
9. ACU45 Short Protector
10. Voltmeter 0-15V
11. Voltmeter 0-15V

II. Test Procedure

A. Calibration


1. Connect equipment as shown in Figure 1 with S1 in Position B and S2 in Position A.
2. Adjust RF Generator (2) to 600mw at 470 MHz on Wattmeter (4) when terminated into 50 ohms.
3. Set Power Supply (7) to 13.6 VDC at 10A at input to ACU45 with Voltmeter (10).
4. Calibrate power readings on Output Wattmeter (5).

B. Short Circuit and Led Test

1. Connect P1 and P2 to ACU 45. Set S1 to Position A. The On and Transmit Leds should light. If D2 (red) on the test box is on the DC power input is shorted to ground.
2. Switch S1 to Position B; the bypass D 3 (green) should be on.

C. Power Output Test

1. Connect RF input and output cables, DC power and control cables to ACU45. Set trimmer capacitors as follows:
C106, C123 Minimum capacitance
C111, C112, C114 1/2 maximum capacitance
Set S1 in Position C, S2 in B.
2. Set Wattmeter (3) to read reflected power. Apply RF input power. Tune C101 for minimum reflected power.

| | | | | |
|--|-------------|---------|--|-----------------------|
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE FRACT. DEC. ANG. ± .XX± ± .XXX± ± | APPROVALS | DATE |  COMMUNICATIONS INC. SATELLITE BEACH, FLORIDA 32937 | |
| | DRAWN CM | 1/29/81 | | |
| | CHECKED | | | |
| | DFTG. SUPV. | | | |
| SERIAL | ENGR. DOJ | 2-13-81 | TEST PROCEDURE | |
| | | | ACU45 RF POWER AMPLIFIER | |
| FINISH | | | SIZE A | PART NUMBER TP-14-248 |
| | | | SCALE | SHEET 1 OF 5 |
| DO NOT SCALE DRWG. | | | | REV. B |

3. Tune trimmer capacitors for maximum forward power on Wattmeter (5) in this order: C112, C114, C123, C111 and C106.
4. Minimum acceptable forward power on Wattmeter is 45W.
5. Maximum acceptable current on Ammeter (8) is 12A. Fine tune for minimum current with no degradation in power out.
6. To tune for 50W maximum power, set power out to 50W by tuning C123 toward maximum capacitance from its maximum power position for minimum current.

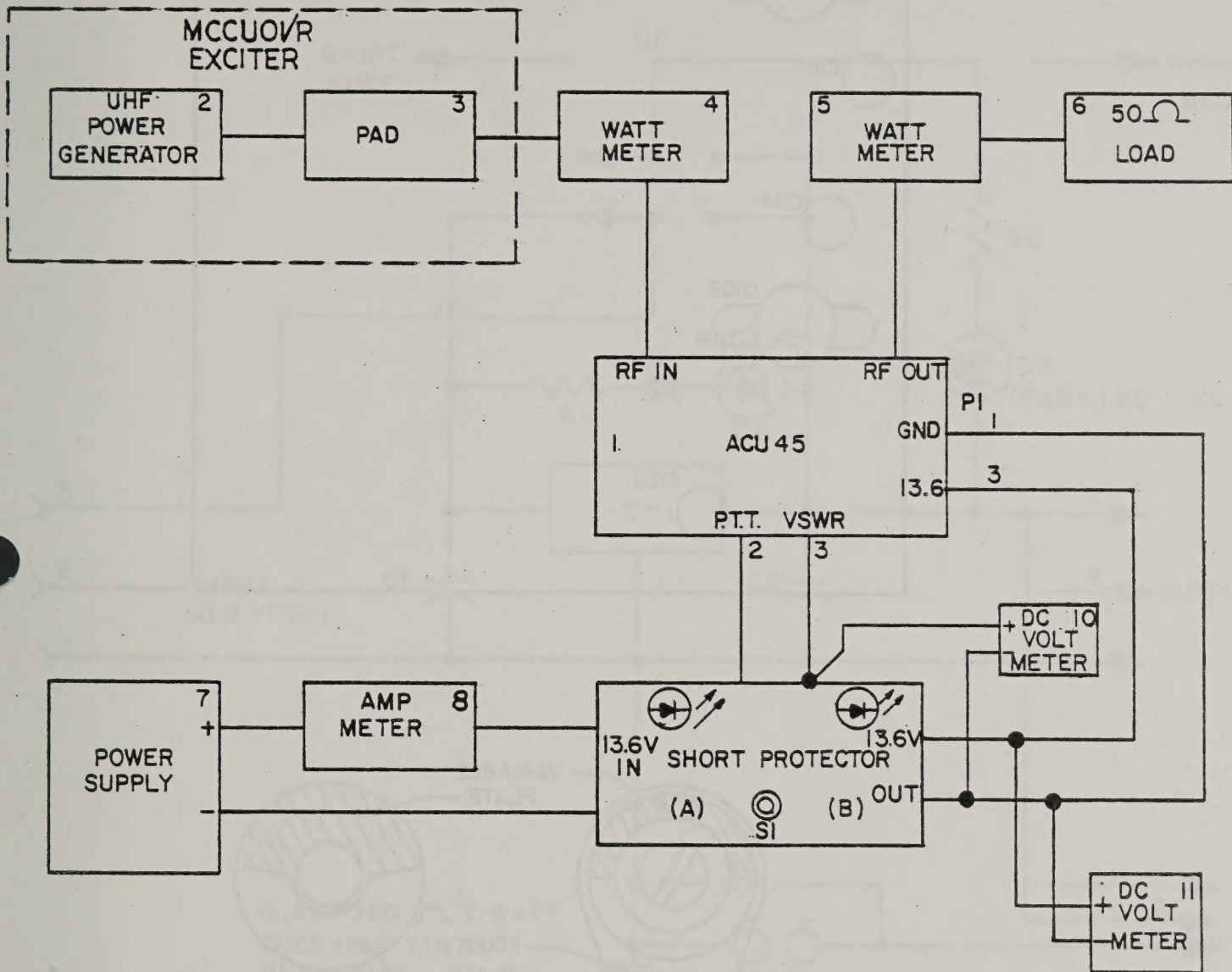
D. SWR Circuit Test

1. With 45W power output the Voltmeter (10) should read 13.6V.
2. Pull coax at Wattmeter (5). Voltmeter (10) should read 5.0V or less.

E. Table of Performance Limits

| Parameter | Min | Typ | Max | Unit |
|-------------------|------|-----|-----|------|
| RF Power Out | 45 | 55 | | W |
| DC Current | 7 | | 12 | A |
| VSWR Forward | 13.2 | | | VDC |
| VSWR Cable Pulled | 0.2 | | 5.0 | VDC |

| | | | | | |
|-------------------|-----|--------------|------|-------------|------|
| DRAWN | GM | DATE 1/29/81 | SIZE | PART NUMBER | REV. |
| APPROVED | BDD | DATE 2-13-81 | A | TP-14-248 | B |
| DO NOT SCALE DWG. | | SCALE | | SHEET 2 | |

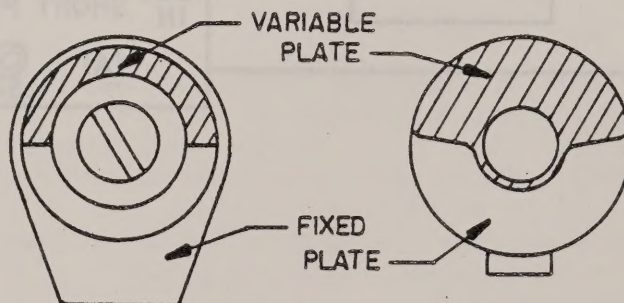
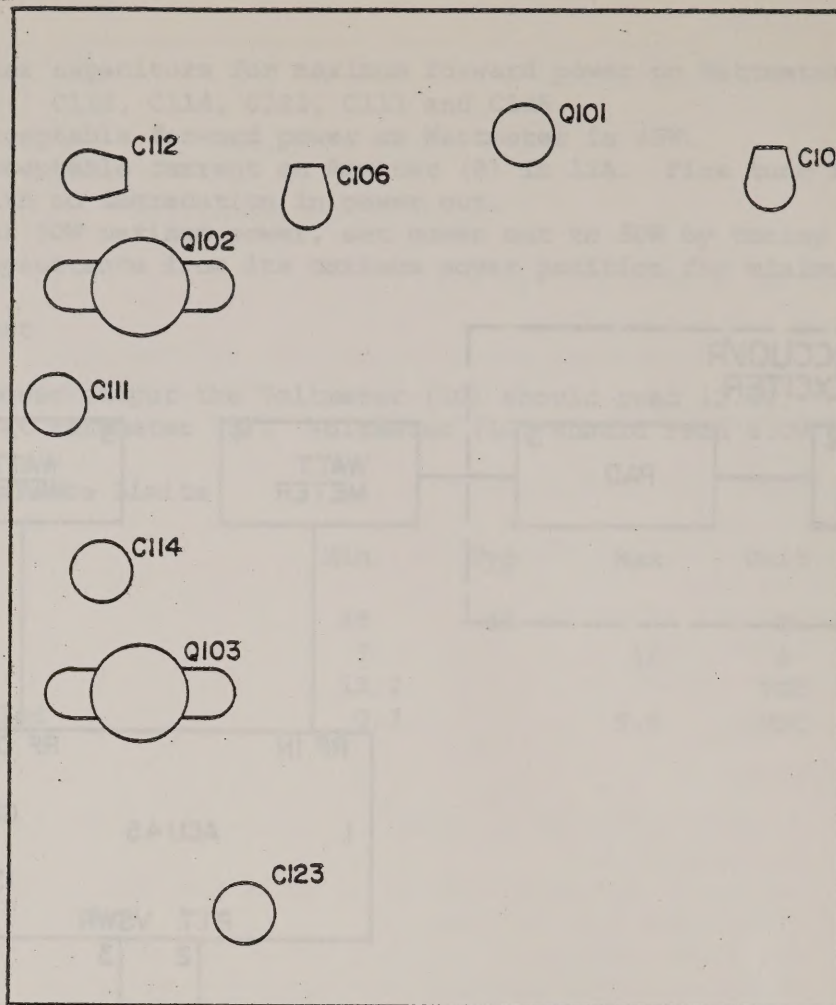


TEST INTERCONNECTION DIAGRAM

FIGURE - I

| | | | | |
|---------------------|------------------|-----------|--------------------------|-----------|
| DRAWN <i>DLF</i> | DATE 11-19-79 | SIZE A | PART NUMBER TP 14-248 | REV. B |
| APPROVED DLF | DATE 11/13/79 | SCALE | SHEET 3 | |
| DO NOT SCALE DWG. | | | | |

TP14-248



STYLE OF C106 & C112

STYLE OF C111, C114 & C123

MINIMUM CAPACITANCE SETTING

TUNING ADJUSTMENT LOCATIONS ACU-45

DRAWN CMcC

DATE 9-24-79

SIZE

PART NUMBER

REV.

APPROVED DLF

DATE 11/19/79

A

TP 14-248

B

DO NOT SCALE DWG.

SCALE



SHEET

4

TP-14-248

SCHEMATIC FOR ACU 45 TEST BOX

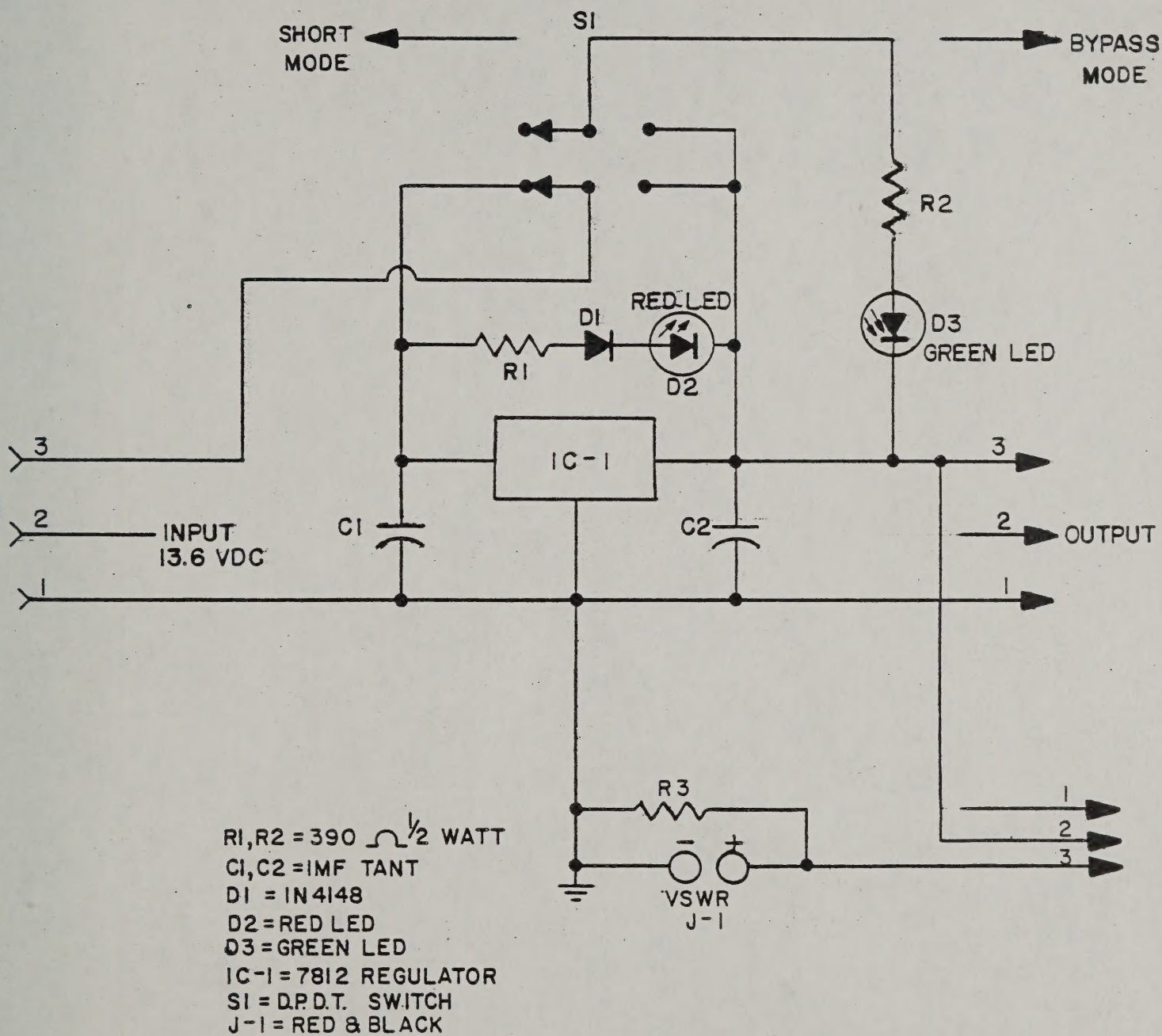


FIGURE - 2

| | | | | |
|---------------------|----------------------|---------------|-------------|---------------|
| DRAWN <i>SDK</i> | DATE <i>11-19-79</i> | SIZE <i>A</i> | PART NUMBER | REV. <i>B</i> |
| APPROVED <i>DLF</i> | DATE <i>11/20/79</i> | SCALE | RP 14-248 | SHEET 5 |
| DO NOT SCALE DWG. | | | | |

